

# 30th AAS Goddard Memorial Symposium

April 9-10, 1992



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SPACE PROGRAMS AND FISCAL REALITY:  
SYNOPSIS (American Astronomical  
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## SYNOPSIS



## INTRODUCTION

The 30th Goddard Memorial Symposium of the American Astronautical Society (AAS) was held April 9-10 at the Radisson Mark Plaza Hotel in Alexandria, Virginia.

The two-day symposium "World Space Programs and Fiscal Reality," brought together leading experts representing various nations and space disciplines.

The majority of space powers around the world have created a situation, at least in the near term, in which the desire to initiate new programs exceeds the resources these nations are willing to commit. This situation suggests a need for increased international cooperation to share the financial burden, bring a broader range of scientific and technical expertise to bear on increasingly complex problems and avoid expensive duplication of effort.

The symposium was dedicated to addressing the dilemma created by today's worldwide fiscal climate and sought to examine the extent to which increased international cooperation can play a role in its resolution. Given the global nature of the symposium's theme, international participation in the program was the most extensive of any AAS Goddard Memorial Symposium to date.

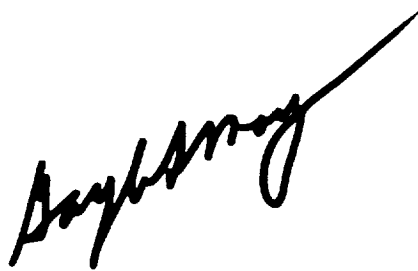
Due to the keen interest in the subject matter of the symposium, a set of rapporteurs were selected to provide a timely synopsis of keynote, luncheon, and session presentations. This document combines those summaries in the hopes of capturing the more substantive comments presented during the two-day program. A full proceedings of the symposium will be issued by the AAS later in the year.

The AAS encourages reproduction of this synopsis to promote discussion and debate regarding the varying views and subject matter contained within the following pages.

Special thanks to our rapporteurs for their assistance: Kevin Madders, European Space Agency, Paris; Dave Dooling, D2 Associates, Huntsville, Alabama; Linda Billings, BDM International, Inc., Washington, D.C., Michael St.G. Stephens, Canadian Embassy, Washington, D.C., and Leonard David, Space Data Resources & Information, Washington, D.C., who also served as overall editor of this synopsis.



Ian Pryke, Chairman  
30th AAS Goddard Memorial  
Symposium



Gayle L. May, Co-Chairman  
30th AAS Goddard Memorial  
Symposium



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Thursday, April 9, 1992

KEYNOTE: "The Problems and the Opportunity"

SPEAKER: Roy Gibson

RAPPORTEUR: Kevin Madders

Roy Gibson, Former Director General of ESA and now an international consultant, served as keynote speaker. He framed his remarks around discussion of how government investment and support for space can be maintained in a way that:

- Observes financial restrictions;
- Applies space technologies, where appropriate, to global priority problems, and especially to the environment;
- Preserves space nations' technological base, while ensuring also that non-space nations benefit;
- Contributes to a lasting global peace through international cooperation;
- Encourages a private sector climate, while not jeopardizing any of the above?

An answer has clearly not yet been found. Indeed, looking at the present situation, space agencies everywhere appear to be in a state of siege and seem unable to adapt to changed circumstances.

Various relief measures have, however, been proposed or tried. One was privatization, which the remote sensing experience and other instances have shown to be of limited use. Another is international cooperation. But its difficulties are not really understood, and several in the West do not wish to drop their habitual guard.

In this International Space Year and next year, governments need above all to be motivated. They will require a better appreciation of where the opportunities lie, as well as of options that create balance between global, regional and national initiatives, between government and private investment, and between infrastructure providers and users.

If this can be achieved, then space programs internationally will be placed on a solid foundation. But a change of attitude will be necessary on the part of space agencies. Programs must be user-defined and user-driven, including at the level of user departments in governments. This means that a number of lessons need to be learned.

First, space agencies cannot remain the sole judges on program matters.

Second, international cooperation cannot be used as window-dressing. It should not be looked at as a means to maintain an existing program by displacing costs to sub-system providers. Instead, cooperation generally implies a change in the program itself, and ought to be accompanied by the recognition that some loss of control by the program leader should be accepted. This applies equally to the public and private sectors.

What forms could be used for developing international cooperation in an appropriate way? The Rio de Janeiro conference may be one. It could lead to a flexible structure to define and oversee a program, and to address the associated problems of data rights. Another body might take on questions related to the space sciences and space infrastructures. Frameworks more than anything else need to be created at all levels (including in the defense sector), though without at the same time creating bureaucracies. A World Space Agency could, furthermore, act as a midwife to cooperation agreements, but should not aim at exercising an executive role.

With the help of industry, governments need to take the initiative in all of this. But, to get them to act, a change of attitude is needed here, too. Politicians should not simply be castigated for shortsightedness when they fail to deliver the desired levels of funding. They need to be convinced, and be convinced as users of the global benefits of space technology. Staging new space "spectaculars" is not the way to accomplish this.

And most of all in the present circumstances...the space community should lobby less and listen more.



Thursday, April 9, 1992

SESSION ONE: "Directions to Tomorrow"

SPEAKERS: W.M. (Mac) Evans  
Karl E. Reuter  
Samuel Keller  
Igor Khripunov  
Masanori Nagatomo  
Kangyuan Zhao

RAPPORTEUR: Dave Dooling

An important theme to notice while reading the summaries of various space activities is that each nation is trying to develop at least minimal expertise in almost every discipline of the broad arena called space. It is difficult to call such efforts duplication. However, most are either complementary or competitive, and they do reflect the perceptions that excellence or competence in space technologies is important to national competitiveness.

Significantly, most of these programs are facing the same problems with increasing costs as more sophisticated missions are attempted, and virtually plan more programs than they will be able to fund.

This session offered an overview of future plans of the major space organizations around the globe: The U.S., Europe, Japan, Canada, the former Soviet Union, and the People's Republic of China.

**Canada**

The Canadian Space Agency (CSA) is going through long-term planning that will set priorities into the early 21st century. As outlined by W.M. (Mac) Evans, CSA vice president of operations, the planning started in the summer of 1991 and was to wrap up in the fall of 1992, but will probably finish in early 1993. Evans said that the CSA is facing an "Everest challenge" - climbing the leading edge, then "falling off the cliff" as funding peaks in the next year or two. Through 2000, CSA's total budget is \$3.65 billion, divided among Space Station Freedom (35 percent), RadarSat (13 percent), and various science and technology programs.

The long-term planning which will set new priorities is taking place within eight "classical working groups" with specific mission areas. In addition, various elements of the nation, including provincial governments and interests outside CSA, are being asked what the nation should do in space. The results will be compiled later in 1992, and recommendations made and forwarded to the Cabinet. It was the "overwhelming success of the consulting process" that caused the planned completion date to slip. Areas covered by the eight working groups include: space infrastructure, RadarSat usage and follow-on, Earth observation, satellite communications, space science, space technology.

In most areas, Evans said, CSA wants to continue to build on existing strengths, such as robotics and power systems in infrastructure, and user

development programs and RadarSat follow-on missions in Earth observation. New fields are being considered as well, such as small satellites that would allow graduate students to build and fly an experiment within their academic career, and "value added" projects for remote sensing data. The space sciences group is the most vocal, he added, and microgravity materials research is growing. Canada is also considering expanding beyond sounding rockets and developing a modest orbital launch capability, something which it has deliberately avoided thus far.

"We have considerably more ideas on the table than we can hope for the government to fund," especially given budget realities, Evans concluded. A better balance is needed between large and small programs - too much of the CSA's budget goes to Space Station. And while international cooperation continues to be an important aspect of Canada's space program, "We are missing some opportunities by not having our own national program" where Canada can control the schedule and priorities, Evans said.

## Europe

While broad international cooperation is something which large national space programs are trying to achieve, it is what allowed the nations of Western Europe to combine their efforts and have a large multinational program that rivals some aspects of the American and Russian programs.

Cooperation started at the scientific level, said Karl E. Reuter, Head of Cabinet for the European Space Agency (ESA), then grew as member states realized the political and economic dimensions. This led to the formation of the European Space Research Organization (ESRO) and European Launcher Development Organization (ELDO), and ultimately to their merger as ESA.

"One of the main purposes [of ESA] was to keep European industry competitive and on good terms with other countries," he said. And it has lived up to that expectation. Reuter said that space technology has played a significant role in modernizing European industry and in how it manages its affairs. "It taught Europe to think and act in a more flexible way [and has been] one of the most unifying forces in Europe."

The advent of a single European market will soon make their main differences disappear. Sustaining and enhancing European competitiveness and industry continue to be main goals, and Reuter noted that, "Europe must master all areas, including manned space flight." It will do that with the Hermes shuttlecraft and the Columbus elements of Space Station Freedom.

But like the Canadians and Americans, ESA is going through a major reassessment of its space programs and policy. Environmental monitoring has assumed greater importance, and the political structure has changed radically with the fall of communism. In November 1991, the program was adapted to meet new fiscal realities while maintaining political ambitions. That process reaffirmed the ESA's pursuit of all fields of space, but member states instructed the Agency to reconsider proposed large programs and find ways to expand cooperation, use the capabilities of non-member states, and build world trade. Agreements are being negotiated to start bringing central European nations into ESA, Reuter said. Russia will be expected to honor agreements made in 1990, and study contracts are being negotiated.

The ESA ministers now recognize the "unique contributions" that Earth observations can make, and the agency is now forming a strategy on how to implement goals within given budget pressures. "We, in Europe, feel that we are still very much at the beginning of the space age, and that much needs to be done to gain full benefits," Reuter continued. They also are convinced that wider and improved international cooperation -- on an equal footing -- will become increasingly important. "Only by uniting our efforts and resources of the world's space agencies [will we] be able to stand up to the challenge " of environmental monitoring.

## **America**

By contrast, Sam Keller, Associate Deputy Administrator, National Aeronautics and Space Administration (NASA), was less certain about the status and future of the American space program given that the agency was "in a period of indecision" as Congress decided funding and Dan Goldin, the new NASA administrator, was taking the helm.

A major issue that Keller explored is funding for basic space technology development. Keller said that the agency has become more aware of the necessity of not neglecting space technology since the ability to adjust to tomorrow's needs is based on technology work funded today.

"It is essential to recognize, in agencies like NASA, that most of the money is in large, long-term projects," Keller said. "They are the hardest to kill off. We must resist whittling at research and analysis (R&A) and small programs that disappear with little impact [to the budget]." Such whittling can kill the base that lets you move ahead, he said.

Keller said, however, that killing the Comet Rendezvous/Asteroid Flyby (CRAF) mission in the 1993 budget plan "was the right decision" that will allow the agency to move onward to smaller planetary probes, just as the Earth Observing System is moving to a series of smaller platforms.

"It is important to recognize, when you evaluate programs, that we are trying to do different things," he said. Mission success should be measured not by failures that occur on most missions, but by the knowledge which is brought back. The Hubble Space Telescope has been roundly criticized for its primary mirror flaw, yet findings reported at a recent American Astronomical Society meeting make it "one of the more successful failures we have ever seen." The decision to turn off the Magellan Venus radar mapper was difficult, but "when you have 95 percent of the data, it's better to go on to other things."

Like ESA, NASA is adjusting to changes in the world political structure. "We have to remember that the Cold War is over and most of us forget that our space agency is in place because of the Cold War," Keller cautioned. "We have to expect that our space program may be part of the peace dividend," a target of funding cuts rather than a beneficiary of other agencies' cuts. With the advent of peace, the potential for international ventures not only will expand in ways no one could have predicted, but will become extremely important. As things change over the next few years, the U.S. must "develop ways to support the Russian space program in transition - it would be unforgivable to let it die."

Keller concluded with a message that has been sounded by a number of space advocates over the years, that the public perception of the value of space exploration must be improved, and that the space community must quit preaching to its own chorus.

## **Russia**

Despite its political upheaval, Russia "was and remains a great space power," said Igor Khripunov, first secretary of the Russian embassy in Washington, D.C., as he gave a brief overview of his nation's space history.

The Space Race, he said, was motivated by ideology and politics. Sputnik, the first artificial satellite, had a great impact on his generation, including the message that "we succeeded and America will never dare strike us." And contrary to the official Soviet history, many launches and launch attempts were ordered by then-Premier Nikita Khrushchev for state anniversaries and other propaganda reasons. In turn, these led to several disasters because the vehicles were not ready.

Neither was the time right for international cooperation. That did not occur until detente was formalized by Nixon and Brezhnev in 1972, and led to a number of joint efforts capped by the Apollo-Soyuz Test Project in 1975. Then it all but died in 1982 when the Cold War resumed and President Reagan cast the USSR as "the Evil Empire," Khripunov continued. Some agreements were produced in 1987 -- and are expiring now -- but were still dominated by politics. A proposal to fly a space rescue demonstration was declined because the Soviets would have been cast in the role of the rescued party.

"Gradually, and painfully, the impediments are being removed," he said, and there are encouraging signs with the pending sale of the Topaz space reactor.

What is left of the old Soviet space program is now run by the Commonwealth of Independent States (CIS), with Russia accounting for 85 percent of the budget.

A number of tough issues are being worked, such as Kapustin Yar, which holds a major launch facility, being offered to ethnic Germans as a homeland. At the same time, the newly formed Russian Space Agency, which has a former military officer as its director, wants to rebuild its industry along rational and commercial lines.

"The bottom line is to put space at the service of the civil economy," Khripunov said, and to separate military activities from civilian. A major example is the proposed Global Air Transport Satellite System which will use satellite navigation systems to help pilots optimize their routes and thus enhance safety and save fuel. Russia will start adapting its military Glonass navigational satellite system in 1995.

Khripunov closed by reading from a Russian satire in which two cosmonauts are stuck in orbit aboard Mir, apparently with more food than the average Muscovite has. When they ask when they can return to the Motherland, mission control asks, "What Motherland do you mean?" Eventually their station is sold to the Americans for scrap. While the audience chuckled, Khripunov kept a straight face.

## **Japan**

Japan's National Space Development Agency (NASDA) has a future that is ambitious for its small budget, said Masanori Nagatomo, NASDA's Washington director, "but you cannot get growth without plans." At present the space budget is too small compared to the national budget.

Japan's policy is to develop its space capabilities along six major lines: transportation and launcher development, place emphasis on manned space flight, to advance technology, to cooperate with the private sector, to use space for peaceful purposes only, and to promote international cooperation.

Major program areas include the new H-II class of launcher, Mission to Planet Earth, materials processing missions including Spacelab J and the TR-1A suborbital rocket; an unmanned, retrievable space platform; space infrastructure with the Japanese Experiment Module (JEM) on Space Station Freedom as a central element; a data relay satellite; a small spaceplane experiment to be followed by a larger rocket plane; and lunar surface exploitation evolving into a permanent Moon base.

## **China**

The sixth major national space effort is that of the People's Republic of China. "When we talk about the Chinese space program, it's a very modest program," said Kangyuan Zhao, First Secretary for Science and Technology at the Chinese embassy.

China's decision to enter the space age came in 1957 after Sputnik I. Three types of sounding rockets were developed; in 1965, design work started on the first satellite which was launched in 1970. All the work was done by the Chinese people, Zhao said. A total of 33 satellites have been launched since then, including 12 recoverable satellites. It is the third nation to master the latter technology, the third to use cryogenics, and the fourth to launch multiple satellites on one vehicle.

China has also entered the commercial space business with the launches of foreign communications satellites. It is also mastering remote sensing technology to help in land management, particularly after earthquakes when communications and surveys are inadequate and local officials overstate damage.

Space will continue to be used to improve and modernize the quality of life for China's people, Zhao said. "Because China is a developing country it is not possible to launch an ambitious program," he said. But it still seeks international ties and hopes that cooperation will be promoted and will benefit the nation.

## **Epilogue**

The panel's comments addressed just the programs of the world's six largest civilian space agencies. But, just as each the six major programs appeared to be variations on the same theme, allowing for differences in political culture and national personality, programs run by developing nations like Brazil and India are miniature versions of the major nations.

The extent of similarity may have led one questioner to anticipate Friday morning's session and ask whether the time was right for a World Space Agency to be formed. Although not answering for the panel or ESA, Reuter offered a practical response in suggesting that while there is no need for such a world body as an executive agency, one is needed to coordinate programs and strategies among nations.

Thursday, April 9, 1992

LUNCHEON SPEAKER: Senator Barbara Mikulski

RAPPORTEUR: Kevin Madders

Senator Mikulski (D-Md.) presented the luncheon address, "The Situation Facing Congress." In her view, the situation regarding space encompasses the "peace dividend" that is now becoming available and should be used for space. However, the budget reduction measures now in force prevent any transfers from the defense to civilian or international affairs budgets. And it will be an occasion to match Jericho if these "firewalls" fall anytime soon. This is despite the fact that, under a risk-based defense strategy based on flexible response, transfers could be made without "hollowing out" the Defense Department in any way.

Should the firewalls be maintained, then Fiscal Year (FY) 1993 will be a very tough year, considering the demands to meet veterans' and other needs. This means that the Space Station will again be in danger, even though this project is crucial and governed by international agreements. Regrettably, it may once more be a case of "shrink or re-think".

As shown by the Space Station program, but still more so in light of today's circumstances, space ventures require an open mind to international cooperation, since it can save money. Such cooperation can include purchases from the ex-USSR, and we must be ready to consider using Energiya and other Russian space capabilities. The State Department should stop blocking initiatives here.

Returning to national programs, the National Aerospace Plane (NASP) project provides the U.S. with a chance to leapfrog over its competitors. It must be supported, but the right source of funding for this is the Defense Department, not NASA.

On the Moon/Mars effort -- the Space Exploration Initiative -- the Congress will not support this program at this time. Congress will, however, sustain the other NASA programs already undertaken. These include research on a heavy lift vehicle, though this item is not a project for this decade.

Regarding the overall health of U.S. research and development, Mikulski said that the national space efforts necessarily fit into a wider challenge facing the U.S. at this defining moment. The issue here is one of ideas and leadership. Imperialist communism has passed, yet there is a new war over America's future. To win it, America needs to fight this war with swift, aggressive leadership in order to gain a stronghold over the markets of the world. For exercising this kind of leadership, a navigational chart is necessary. It can be termed a "National Technology Policy," a term that is akin to what some more loosely define as "industrial policy".

In the Executive Branch, there is presently fear of having a policy aimed specifically at promoting industrial competitiveness. Yet the ills due to the absence of one abound on all sides, in steel, in stereo and television equipment, in education. Congress must take action to correct them if the Executive Branch fails to do so.

A New Technology Policy will produce smart children, workers, managers, and government. Effort should be oriented towards promoting pre-competitive activities. And Government itself should indeed be re-focused, ending the present "dance of dinosaurs."

What is urgently needed is an entrepreneurial Defense Advanced Research Projects Agency (DARPA), plus support to NASA and the National Science Foundation, with the creation under the latter of a National Manufacturing Institute. U.S. industry must be retooled with the potential for leadership.

Legislation on the environmental DARPA idea will be introduced during the next Congressional session. Tax incentives also need to be used to reward entrepreneurs. Specifically, the investment tax credit should be reintroduced, along with capital gains incentives. Further, the U.S. should change its anti-trust laws. These are adapted to 19th century monopolies, not a 20th century economy. And a new partnership between Government and the private sector needs to be formed for several projects, including a second-generation supersonic transport (SST) -- like the British Concorde -- as well as a magnetically levitated train, and an electric car.

Finally, looking outward, and particularly to Europe, Congress hopes that this will be a cornucopia of opportunities for U.S. firms, and not a "Fortress Europa."



Thursday, April 9, 1992

KEYNOTE SPEAKER: Mark Albrecht

RAPPORTEUR: Kevin Madders

Executive Director of the National Space Council, Mark Albrecht, provided the day's second keynote address on "Making Space Policy in Today's Environment".

As it was stated to the AAS Goddard Memorial Symposium in 1990, Albrecht assured the audience that space remains a Presidential priority. The difference is the sizeable progress that has been achieved over the intervening years to today.

To trace this progress, Albrecht recalled the five key elements which the Vice President set down in 1990 and which remain the essential elements of U.S. space policy:

- To maintain a space launch infrastructure as a national resource;
- To open up manned and unmanned exploration;
- To focus on Earth applications;
- To expand commercial uses of space;
- To ensure that free use of space is maintained.

An overarching object of national space policy is, however, also to implement these goals in a coordinated way across the U.S. Government, thus permitting it, in President Bush's words, "to do more, for less". This idea was brought to the fore by Congress in 1988 but, in fact, lies behind the National Space Council's role as defined in the 1958 National Aeronautics and Space Act. The report accompanying that Act added Congress' view that space activities should be conducted in a way that gave "room for alternative approaches", and that led to a "well-rounded, comprehensive national space plan". In exercising its coordinating role today, the Council furthermore acts as an effective means to resolve inter-agency differences in order to further higher, national priorities.

How well, though has the National Space Council done in practice?

First, the various departmental objectives have been aligned and brought under a series of policy directives and decisions in the following areas:

- Launch Vehicles - A National Launch Strategy, which was established in July 1991. Concerning the need to acquire funds for future launch capabilities, further missionary work needs to be done. However, Executive level agreement has been won as to what is needed in terms of cheap, reliable and responsive systems. These would be developed jointly by the Defense Department and NASA;

- Earth Applications - Here, the technical approaches to such issues as the monitoring of global warming have been studied, and project leaders have been identified. For Landsat, this is managed jointly by NASA and the Defense Department, but for the environment, it will be NASA, benefitting from inputs from other agencies;
- Manned Missions - A human return to the Moon and dispatching astronauts to Mars is a strategy that first concentrates on establishing the Space Station, but also aggressively exploring ideas for Space Exploration Initiative (SEI) technologies;
- Commercial Space Launch Policy - This was developed hand in hand with the private sector. The Administration's aim is to act as a single team in creating a favorable environment for U.S. commercial interests.

Secondly, it is useful to examine how the process has operated. A full interagency process was initiated for each policy item. Debate followed, with each agency's principal registering its view. Consensus was achieved most of the time, but, where an agency had formally to declare its non-concurrence, the matter was taken to the President. It is a process that is formal, thorough, and provides consistency in reaching Presidential decisions.

Turning to the items with which the Council will be concerning itself in the future.

On the National Aerospace Plane (NASP), an inter-agency group has already been established, at the request of Defense Secretary Cheney. In 1989, President Bush instructed NASA and the Defense Department to give high priority to Phase 2 of the program. The group will be reviewing the results of this phase, before Phase 3 is embarked upon.

On Landsat, the President's directive required that a management plan be elaborated. It is now being circulated for review.

On procurement, an advisory body has been reviewing procedures. The Defense Department is already changing some of its practices. A Space Council working group's review of procurement practices could lead to pilot tests being initiated, aimed at incorporating sound business principles in government procurement.

On international cooperation, the Cape York "spaceport" concept in Australia was addressed by the Space Council under this rubric.

In conclusion, the United States has today what it effectively lacked three years ago, namely a coherent space policy. The criticisms that one hears now are that, if anything, the National Space Council is doing too much, rather than too little.

Looking to the years ahead, one must be aware that the 1990s will be a decisive decade. While some seem to view space as merely an expensive sideline to the American experience, we know that space can inspire youth and save jobs in a way little else can. These are among the reasons why the President has committed himself to space as a pillar of society, and is seeking to work with Congress to make it so.

Just as we today can look back at the brave decision taken in 1931 by President Roosevelt to spend \$2.5 trillion in today's dollars on highway construction and say that decision was the right one, it is Albrecht's hope that in 2020 or 2030, people will be able to look back at the decisions being taken in our day and be able to say the same thing.

Thursday, April 9, 1992

## SESSION TWO: "Constraints to the Vision"

SPEAKERS: Michael Griffin  
Karl Reuter  
Dennis Burnett  
Andrew Aldrin

RAPPORTEUR: Linda Billings

This session took a budgetary perspective on the key issues that constrain our ability to meet our desired goals in a timely manner. Discussion focused on the strengths and limitations of political structures, industrial environments, cultures and technologies of nations around the globe.

Session chair Joe Hezir of the Office of Management and Budget opened session two by stating that national security and prestige are no longer drivers for the space program. Hence, funding limits are a serious consideration. [See background charts in appendix]

NASA Associate Administrator for Exploration, Michael Griffin, said that we have to ask "at the national level" what it is that we want our space program to do. In the same way that President John Kennedy didn't know precisely how the country would land a human on the Moon when he announced that goal, we don't know today how humans will be sent to Mars.

Apollo is not the model for today's Moon-Mars exploration initiative. But while we need to start small, it's important to start. We also need to "reprioritize some of our objectives." Addressing the question of how we can proceed with an exploration initiative on annual appropriations, Griffin said the answer is that we know how to do it; we only lack the commitment to spend the money.

Three billion to five billion dollars per year would be sufficient to sustain such an exploration initiative. Rigorous program management is an absolute necessity; you almost have to carry a 45-caliber gun to shoot the first guy who proposes to "do it better." To succeed, the exploration initiative must stay within the envelope, it must adhere to a plan with iron discipline.

In addition, keeping a lid on spending is a primary concern today. But it is the rapporteur's opinion that we also need to think about the need to maintain our defense industrial base, now that Defense Department spending is on the decline.

Senator Mikulski spoke today about the need for industrial policy. One could also argue for the need for economic conversion planning. We need a national industrial policy and a national economic conversion program that will enable the military-industrial complex to apply its research and development and manufacturing capabilities and its highly skilled work force to non-military enterprises that will improve our competitive position in global markets. We don't know yet how the National Exploration Office, headed by Michael Griffin, is going to work, but it could initiate a sort of mini-economic-conversion program, to set an example.

Griffin offered some good ideas for pursuing missions to the Moon and Mars on a relatively small budget. But we'll have to wait and see how he is going to change the system so that he can do these missions his way. He needs to squeeze a little bit more money out of Congress -- \$5 million or \$10 million or \$15 million a year [that is, something like current levels of funding] -- is a long, long way away from the \$3 billion to \$5 billion a year that he says he needs. And he needs to explain how what he wants to do meets public needs.

Karl Reuter, ESA's Head of Cabinet, reported on how ESA came to establish a long-term plan for a European space program. While ESA's budget is a much smaller portion of Europe's GNP compared to U.S. space spending, ESA's budget growth has been steady for the last seven years or so.

Reuter talked about Western Europe's commitment to space, explaining that ESA is slowing down somewhat, but still committed to a European space program. He noted that ESA has slowly but steadily increased funding over the past several years. That looks like a commitment. At the same time, ESA is working with Russia and is also considering, in the long term, taking on that nation as a new member. While the Europeans are willing to take their time, it is this rapporteur's feeling that Americans are always in a hurry to finalize all the details of their plans.

Brenda Forman of Lockheed Corporation [not present -- paper read by L. Billings] said that we can't open the space frontier with gold plated hardware. The U.S. aerospace community has not adopted mass-production techniques but still produces unique "hand-made artifacts" designed to unnecessarily stringent military specifications. The "Not-Invented-Here" syndrome still plagues both government and industry with regard to doing things in new ways. We won't get to the Moon and Mars this way. She predicted that the aerospace community is not likely to change its ways in the foreseeable future. But she also said that someday, "some dogged entrepreneur" will figure out how to pull off a small but successful space mission independent of the current system.

This rapporteur shares Forman's opinion that we can't open the frontier with gold-plated hardware. But we have become used to going for grade-A every time - a habit that has brought us to the point where we are losing opportunities to explore (with the Comet Rendezvous/Asteroid Flyby, and perhaps Cassini, for example) because our plans are too grand. Getting back to the point: we need to do what we can with the money we have instead of waiting around until Congress agrees to give us lots more.

Dennis Burnett, a partner in the law firm of Haight, Gardner, Poor and Havens, reported on White House policy positions as barriers to international space technology transfer. He noted that the Bush Administration has recently changed its position on U.S. purchases of Russian space technology. It's a matter of looking at the glass and seeing it as half-empty or half-full: the old position was that purchase of Soviet space technology was prohibited unless it would benefit U.S. national security; the new position is that such purchase is permitted unless it poses a threat to national security. If the United States had had a policy goal in

mind as it negotiated cooperation agreements with partners in the Space Station Freedom program, a technology transfer agreement would have fallen into place fairly easily. However, the cooperation agreement has a complicated two-page tech transfer provision that should have been only two sentences long.

Burnett addressed barriers to international technology transfer. And while he confirmed that U.S. institutions are having a difficult time changing as the rest of the world changes [e.g. with regard to the purchase of Russian space technology], it is clear in this rapporteur's view that small changes can occur -- for instance, when the person in charge changes [a reference to a personnel change at the State Department that resulted in a change in position with regard to Russian space technology transfer].

Andrew Aldrin of the RAND Corporation reported on the results of his trips to the former Soviet Union over the last 18 months to find out what space technology is available. He noted that the new Russian Space Agency (RSA) currently consists of one person, the director (who has requested a staff of 250). The Ministry of Industry will monitor space contracts for the RSA, as it did under the old Soviet system. Separate organizations exist to perform separate space missions (e.g. NPO Energiya, NPO Molniya, NPO Foton), and long chains of command exist.

Because of the complexity of the system, Aldrin said the best way to pursue space business with the Russians is to start developing contacts at the lower levels of the system. Another constraint to doing space business with the Russians, for U.S. companies, is that individual businesses are collecting different pieces of the Russian space puzzle, but they are refusing to share their information. Hence, no one has a complete picture.

Aldrin probably offered us the best advice for dealing with constraints to the vision: whatever you want to do, don't just sit around talking and thinking about it -- just go do it. In the case of purchasing Russian space technology, just go there and do it.

In summary, in this session, we talked about several constraints to the vision. But I think we all agree that the only one we really need to worry about is money. I'm reminded of what my parents used to tell me when I was a kid and wanted everything that all the other kids had: They told me there just ain't enough money to go around.

So it seems that the practical thing to do is to stop whining about what we can't do for lack of money and just go ahead and do what we can with the funds that are available. To put it in the vernacular, we need to get real.

Unfortunately, due to an illness which later claimed his life, former NASA Administrator Thomas Paine couldn't deliver his scheduled talk about where we might be in space today if we had continued Apollo-level funding for NASA through the 1970s and '80s and into the '90s.

Thomas Paine's enthusiasm will be missed, particularly his vision of how to rekindle this country's long term future in space, when John Kennedy is not the President of the United States, when the Cold War does not have the American people mobilized against an Evil Empire, and in a time when the U.S. and the CIS are no longer the only nations that are using and exploring space.

Friday, April 10, 1992

DEBATERS: John Logsdon  
Hollister Cantus

RAPPORTEUR: Michael St.G. Stephens

A special debate was held, with the motion put forward that the time has passed for carrying out large scale space endeavors as national initiatives.

The Debaters were John Logsdon of George Washington University who took the pro position with Hollister Cantus of Lockheed Corp., taking the con position.

Logsdon opened with the affirmative case that while conditions today did not oblige the United States to cooperate on such projects, and in fact the U.S. could go it alone in space, collaboration offered a particular set of benefits the U.S. space program would need in the future.

The issue that needed answering prior to collaboration, he said, was whether these projects should be undertaken on any basis at all. Logsdon stated that large-scale space endeavors could not be justified as a technological and economic stimulus, nor as promotions for education, for which they were ill-equipped. They did need to be undertaken, however, on the strength of their own merit, he said.

On the question as to whether these projects were best pursued on a national or international basis, Logsdon contended the international route offered the best benefits for the U.S. International cooperation, he continued, could allow the U.S. to remain a leader in space and also because it offered the pooling of resources and talent from a number of sources, it offset risk, and helped foster a common agenda between nations. Cost savings did constitute a benefit of collaboration but could not, alone, justify collaboration. A unique window of opportunity existed for all spacefaring countries to forge at this juncture a new productive synergy for undertaking large-scale space missions. Failure by the U.S. to develop that opportunity would threaten its ability to carry out the complete range of space projects it needed in the future.

Hollister Cantus challenged the notion that national and international approaches were mutually exclusive, pointing out the two could coexist. Like Logsdon, Cantus did not dispute the need for large-scale projects and went on to extol their value for the U.S. space program. He made a strong case that not only had international cooperation not delivered adequate benefits for the U.S., but it operated counter to the U.S. self interest and undermined public support for the space program. Military competition was being replaced by economic competition and the key to economic competitiveness for a nation was technological leadership. Retention of economic superpower status, a desirable goal for the U.S. in Cantus' view, could be achieved only through a redefined national self-interest. Cantus' first essential for delivering this was for the U.S. to make major national investments in space technology to give it the necessary edge to compete in the new international economic battle. The second essential was to correct the new malaise characterizing the American public which had

arisen over disillusionment with the decline of U.S. technological and economic leadership. Only a shift back to nationalism, which had originally fueled U.S. ascendancy to preeminence in space, stood to reignite the public's enthusiasm for the space program. Constructive fanaticism, the key to regaining pride in the U.S., was indispensable, he said, to reacquire momentum in the space program which, once commenced, ultimately offered the U.S. the road back to global preeminence.

In ensuing counter argument and answers to questions from the floor, the issue of U.S. preeminence appeared central and, at the same time, the most divisive. Cantus argued pursuing U.S. preeminence was the only way to get the U.S. space program back on a sure footing. Logsdon countered that pursuing preeminence was not only infeasible now but it would ensure the U.S. missed out on the benefits of international cooperation.

Fundamentally, the root issue underlying the debate between the speakers appeared to be what form of leadership was in the United States' best interest at this juncture. Logsdon contended the U.S. needed to lead through taking the initiative in partnership with other spacefaring nations and could not afford a preeminent-focused leadership which alienated these other space nations. Cantus countered with the case for a U.S.-focused partnership approach, where the best form of partnership was one where the U.S. would take the initiative in embarking on dynamic projects which would, *sui generis*, attract the participation of these other nations: "Build it and they will come!"



Friday, April 10, 1992

### SESSION THREE: "Cooperation - The Essence of the Future?"

**SPEAKERS:** Roald Sagdeev  
James Beggs  
John Egan  
Ralph Chipman  
Geraldine Baca-Spross  
Kenneth Pedersen

**RAPPORTEUR:** Leonard David

This session sought to examine international cooperation and the role it potentially could play in the future. Speakers addressed international cooperation as a means for alleviating the currently foreseen fiscal situation facing the space programs of the world.

Roald Sagdeev, distinguished professor of physics at the University of Maryland and chairman of the symposium, offered his views of the current economic and political woes of the Commonwealth of Independent States (CIS), formerly the Soviet Union. His remarks were candid and fresh, just returning from a recent visit to the CIS and having met key leaders in the Russian space program.

The state of the former Soviet space program is facing several fundamental problems. In the past, the Soviet space effort was held hostage to politics. Leaders like Khrushchev, Brezhnev, and to some extent Gorbachev, were using spectacular space flights as proof of the superiority of socialism over capitalism. Recent political changes, however, have turned the CIS taxpayer against this argument.

Today, the CIS taxpayer is not concerned with the fascination about space, but more atune to the commercial benefits from space. "This is a direct translation of new rules of market economy which are introduced in the Soviet Union," Sagdeev said. Until quite recently, he continued, the fraction of commercial space programs, within the former Soviet Union's space budget, constituted less than 3 to 4 percent. These commercial assets were telecommunications and navigation satellites. A huge fraction of the Soviet space budget -- 85 to 90 percent -- which constituted military space activities. A "principal client" of manned space projects, the space station, as well as the Buran, also was the Soviet military, he said.

Even today, Sagdeev noted, the tradition of stating that many of the satellites are lofted for solely civilian and scientific purposes, and not military, is continuing.

A second group of problems are related to budget and fiscal realities and have become "a real disaster," with the rate of deficit growth in Russia is gauged as "unprecedented," stated Sagdeev. The overall net sales in retail for the first quarter of 1992 in Russia dropped by 50 percent. Most enterprises are keeping employees, but paying them for doing nothing. Defense industries are expected to lay off many employees, thereby impacting numbers of the organizations that also produce space hardware, he said.

One gauge of cutbacks are the number of launches per year. At its peak the former Soviet launch rate tallied over 100 launches in one year, but dropped in 1991 to 59 launches.

President Yeltsin has signed a decree to create a Russian Space Agency - the first civilian governmental agency in the history of that country's space program. The charter of the RSA follows the spirit of the NASA charter. It will control a dozen or less enterprises that will test and integrate space hardware for launch. Such organizations, such as NPO Energia, will likely be privatized, Sagdeev said, with assets like the Mir space station possibly controlled by share holders. Those Mir share holders could include foreign investors, he said.

The first hard currency contracts have already taken place in the CIS. Sagdeev estimated the influx of foreign money to the current former Soviet space program is nearing \$30 to \$50 million annually. Most money is not coming in the form of cash but in hardware contributions, from NASA, ESA and others, by contributing to joint projects.

One key component of Russian space salesmanship, Sagdeev said, is the country's launchers, which he called a "clear cut advantage over the rest of the world." The Proton booster is the least expensive and most reliable, making it a marketable item worldwide. Proton does have a shortcoming, noted Sagdeev, in that it can only place modest payloads into geostationary orbit. An accelerated effort is now underway to upgrade the Proton, such as creation of a new upper stage to increase the booster's payload lift capability into geostationary orbit. The Proton upperstage upgrade is being paid for by the Indian government.

Both the Buran space shuttle and the Energia heavy lift booster are "endangered species," Sagdeev reported, due to economic constraints. A less-powerful Energia derivative -- the Energia-M -- is now being pursued. Disputes between space authorities in Russia and those in the Ukraine, who provide hardware components and expertise, are slowing Energia-M development, however.

As for any Russian manned Mars mission in the near future, Sagdeev said: "Anyone who would talk about manned missions to Mars in Russia would be immediately killed by hungry people in food lines."

In closing, Sagdeev advocated that other nations should consider investment in the CIS over charity, thereby mutually benefiting every one in the developed world.

Former NASA Administrator, James Beggs, pointed out why competition is not a bar to the imperative of international cooperation. Beggs noted the findings of a recent report of the National Academy of Engineering that observed an acceleration of two mutually reinforcing trends: the convergence of technical capabilities of industrialized nations and the global integration of formerly discrete national technical enterprises.

Among the positive reasons why international cooperation is an imperative:

- By sharing costs and risks, spacefaring nations can speed the development of space and undertake more ambitious missions;

- It draws upon world talents and facilitates technical and scientific exchange on an informal basis;
- It provides a window on technology of competitor countries and potentially provides a better understanding of international markets.

To insure that no partner gains significant advantage from a multi-country undertaking, Beggs stressed that comprehensive agreements are needed, up front, and should outline the following:

- Clear program and system management responsibility must be identified, and the relationships between operating organizations must be clearly defined;
- Configuration management must be clearly defined;
- There must be clear and well defined interfaces which require a minimum of technical exchange;
- Access to each others research establishments and contractor organizations must be well controlled.

U.S. and foreign companies have long worked with each other and already have established ways to protect their competitive positions. Even with these agreements in place, having no technology transfer during the process of collaboration cannot be guaranteed. Even if such transfer did occur, "the advantages of cooperation and collaboration far outweigh the potential damage," Beggs stressed.

Given the fact that technology spreads very quickly throughout the world, it is not a permanent advantage, it is very perishable, Beggs said. Indeed, in some respects, the U.S. has been overtaken by a malaise, with the nation "falling behind badly in the application of technology." It appears that such nations as Japan and Germany are now investing more than the U.S. in civil research and development.

While technology is the key to economic growth, the United States since the mid-1940's has had many technology policies, but no Technology Policy," Beggs said. A balky tax system, legal and regulatory impediments and a lack of a Technology Policy have hamstrung entrepreneurial activities in the United States.

To strengthen our industrial research and development muscle, Beggs suggested a modest agenda of proposals:

- Develop a coherent Technology Policy;
- Improve Government-Industry relations, perhaps akin to that which existed between the predecessor to NASA, the National Advisory Committee for

Aeronautics, and the early aeronautics industry in the first half of the 20th century. Today's relationship between industry and the government has fallen into "an abysmal state";

- Technology validation or proof of concept efforts are required to move technologies closer to market;
- A central point in the Federal Government is needed to plan the U.S. Science and Technology national program. A new agency might be established, or an expansion of the Office of Science and Technology Policy (OSTP) might be possible;
- Reform the procurement system, thereby providing incentive to contractors to apply or license new technology;
- A reformation of the tax and regulatory system is needed.

With these proposals in place, not only would the competitive posture of the American industry be enhanced, but the country need not fear any danger in forming international partnerships, so key to the world's space exploration future, Beggs said.

John Egan, President of The Egan Group, discussed sharing the financial burden by international cooperation - does the process work?

Egan began by arguing that there is no one method or process that can be followed to achieve international cooperation. A number of processes exist in the U.S. and other governments to deal with international cooperation. Various international cooperative space ventures differ from each other because they were initiated by different motivations of the various people involved, Egan said. The question is what motivates international cooperation in space?

For the United States, cooperating with its allies in the Cold War signaled U.S. leadership. On the other hand, the Apollo program involved little to no international cooperation. As time passed, and other nations honed their space skills and gained the requisite financial resources, sharing of costs and the political capital became a motivator for international cooperation. For the U.S., Egan explained, internationalizing projects also meant that such efforts might guard them against Congressional short circuiting, although this motivation has been met with mixed success.

Following a similar pattern was the Soviet Union, motivated to cooperate with its allies and occasionally with the West when it was politically desirable, such as the Apollo/Soyuz Test Project of the 1970s.

In Europe, international cooperation was motivated by different set of motivations: gain experience and achieve an independent capability. To do so,

Europe participated in several space projects, as well as formed the European Space Agency - a confab of nations to provide experience and the resources to develop independent space capabilities.

Japan and other small programs have made use of international cooperation to gain experience, as well. For all of these programs, the cost was in terms of man-hours and money and the benefit of experience. The result of all these cooperative relationships has been significant improvement in the general skills, worldwide, in space technologies, Egan explained.

What motivates countries or for that matter companies to engage in international cooperation? Some say, their own enlightened self interest is reason enough.

Today, we find no country on Earth capable of carrying out the space agenda of their dreams - resources to carry out such ventures are now limited. This has led to the creation of many processes, focused on securing the needed resources for space programs. But relief from some portion of the financial burden, while often "a" motivator, cannot be "the" motivator, Egan said.

Furthermore, if everyone acts in their own self interest all the time, then the competition among the self interests of all parties will preclude any one party from ever achieving their own self interest completely.

Egan addressed the costs associated with international cooperation. Increased travel costs, translation of documents, the series of extensive discussions and negotiations - all require money. Studies by The Egan Group, and others, suggest approximately 10 percent is the added cost of cooperation - not a major factor, therefore, in deciding whether or not to engage in international cooperation, Egan feels.

Today we find a greatly decreased ability, some say a unwillingness, for governments to pay for space activities - particularly large, multi-year infrastructure programs. In addition to these having high development and construction costs, they also bring with them the portent of high operating costs, Egan explained. This is coupled to the world's space agencies and their respective aerospace manufacturing base that, for the most part, are wedded to doing business as usual, the status quo and its preservation, he said.

Egan stated that in large measure, the international cooperative programs have really been national programs - efforts into which others have been allowed to become a part. At this point in history, is it possible to start truly international cooperative ventures that are international from the outset?

There is a clear need for some kind of mechanism by which global priorities can be set and global resources can be pooled in order for the world wide space activities to be of benefit to all humankind. Additionally, such "mundane" space activities as monitoring the environment and improving communications cannot be forgotten. For these essential services, Egan believes the taxpayer will readily put up funds.

Large sums of money could be saved by reducing the amount of duplication across the various space programs. Avoiding this duplication, as well as pooling of funds, and establishing space priorities could lead to the enlightened self interest of all parties involved, Egan said. To assist in this global coordination, a series of high-level meetings is needed to bring together

government, scientific, and industrial space factions, including the recipients of essential services from space.

On a technical issue, Egan stated he is "absolutely convinced" the commercial development of space will not occur at rates of \$5,000 per pound to low Earth orbit. Low cost space transportation is crucial to the development of space.

Ralph Chipman, secretary of the Scientific and Technical Committee of the Outer Space Affairs Division of the United Nations, provided an overview of satellite remote sensing and its use by developing nations.

The launch of Sputnik 1 in 1957, and its circuiting around the globe, established that space was an international undertaking, sparking the United Nations to set up a committee on the peaceful uses of outer space. This was later followed by creation of a U.N. Outer Space Affairs Division and by adoption of the U.N. Outer Space Treaty in the mid-1960s, which remains today as the legal basis for space activities. Part of the treaty is dedicated to establishing that use of space would be for the benefit and in the interests of all countries.

Over the years, formal institutional arrangements have made space technology available to all countries. As example, Chipman pointed to the 1965 formation of INTELSAT. Largely an American initiative, 120 member states are now owners and major users of that communications satellite network.

Similarly, meteorological, storm warning and Earth remote sensing have been utilized by many nations, particularly the developing countries. Meteorology via satellite, in particular, has never been seen as a commercial operation, therefore it is difficult to attribute the cost of the system to individual users.

European, Japanese, American and Indian satellites provide coordinated observations of the Earth's weather. Data from these spacecraft are available to all countries, without permission being required, and without access fees. Nations can procure weather data at nominal costs of reproduction, thereby promoting extensive use of satellite meteorology data throughout the world, Chipman explained.

On the other hand, Chipman added, the policies of commercialization of remote sensing that began in the mid-1980s "have inhibited, and in some cases prohibited," the wide use of remote sensing by developing nations. The dramatic rise in cost for satellite imagery has curbed its application in developing countries for educational use and in environmental monitoring.

There is now realization that all nations need to be involved in global environmental protection, Chipman said. Developing countries need access to space technology and they need financial assistance to do so, he added. The broadest possible use of satellite data in developing countries requires that it be available at low cost, Chipman explained.

Geraldine Baca-Spross, of the Universidad Francisco Marroquin in Guatemala, discussed the awakenings in her country of the space advancements that have taken place. Increased coordination as a first step to enhanced cooperation, said Baca-Spross, means increased communication between those

wishing to coordinate space efforts. "One cannot speak of collaboration if conditions are highly dissimilar amongst the collaborators," she said.

As example, she cited an increase in space interest prompted by the 1990 Space Conference of the Americas in Costa Rica, as well as the establishment of the new American Astronautical Society chapter in Guatemala in July 1991. The establishment of this chapter, and the resulting augmentation of AAS bylaws to suit the new international chapter, provide important guidelines in establishing other international chapters, she said.

To promote space science and astronautics in countries not traditionally exposed to space, Baca-Spross underscored the need for constant exposure of space in those nations through the print and electronic media, lectures and other events. Doing so provides a motivational force and, more importantly, continuity.

She believes space exploration milestones in many nations receive delayed coverage, are very condensed, or are never covered at all. "If indifference has, to some extent, permeated the general attitude towards space exploration in countries linked to space...where national pride may be considered its main spinoff, it is not difficult to visualize the situation in the rest of the world..." she said.

On the other hand, attacks against space exploration can be spurred by issues of poverty, lack of health and educational facilities - common to many developing countries. "This position is not to be excluded or disregarded, as it carries weight and has to be dealt with carefully," she said. Yet the relief to crises, chaos, famine, poverty, war and their consequences is linked to discovery, to progress, to change and to new perspectives and forms of life. Space exploration may well be the environment that provides such relief, Baca-Spross said.

Kenneth Pedersen of Georgetown University discussed whether now is the time to create a World Space Agency (WSA). The establishment of such an organization has been advocated on many occasions in the past. Recent world events, perhaps, give new credence and motivation for this cause, believes Pedersen.

Most certainly, the end of the Cold War also provides a positive sign for consideration of a WSA. Also, there has been a transformation in U.S. attitudes towards multi-lateral organizations. In past years, the United States displayed a negative view toward the United Nations, a view that has changed since the Gulf war and U.N. support in resisting Saddam Hussein, for instance.

Two other factors continue to play a role in defining the need for a WSA. First is the overall complexity of space undertakings. There simply are more countries, more organizations increasingly involved in using or benefiting from space yearly," Pedersen said. The complexity of the missions are also challenging. Both of these factors tend to argue for greater coordination mechanisms and international solutions. Further, the cost of space exploration and application projects is on the increase. "Many see in a World Space Agency an opportunity to alleviate or manage some of these fiscal difficulties," he added.

In defining the characteristics of a permanent World Space Agency, Pedersen said such an entity would be open to the entire global community, and not be a small elitist organization. This entity would be organized on an intergovernmental foundation and would have an authority to make binding decisions that influence,

in a predictive manner, the decisions, activities and behavior of its members. A WSA would also possess a broad charter and not be highly specialized, such as solely collect and disseminate information. Lastly, such an organization would be able to assess and, to some degree, allocate financial resources provided by its members.

Among the benefits of a WSA are elevating the overall acceptability of space activities, in a sense, an enhanced legitimacy of space projects in full view of the world. Through such advocacy of space benefits, a WSA could stimulate an increase in overall resources available to carry out space projects. Other benefits include updating standards and laying out "rules of the road" for safer space operations; and shaping priorities of nations into common space agendas to avoid duplication of effort and better utilize monies available.

Turning to the question of how likely is it that such an organization will emerge today, and how vital is it that it does, Pedersen concluded that the likelihood is not particularly good, in the near future.

Among the reasons, the case has not been adequately made that there are vital national interests at stake that leads to the creation of a permanent international organization and allocate resources in space, he believes. Those who advocate a WSA, Pedersen continued, do so because they are disappointed about their own national government's decisions regarding space and the priorities established.

In addition, the sheer number of intergovernmental and transnational groups already in existence which now provide some coordinating function tends to inhibit the emergence of a WSA.

Yet another reason slowing the evolution of a WSA is that current governmental space agencies incorporate powerful competitive and security interests within their programs. How to balance cooperative efforts with competitive and continuing security interests is likely to continue for years hence.

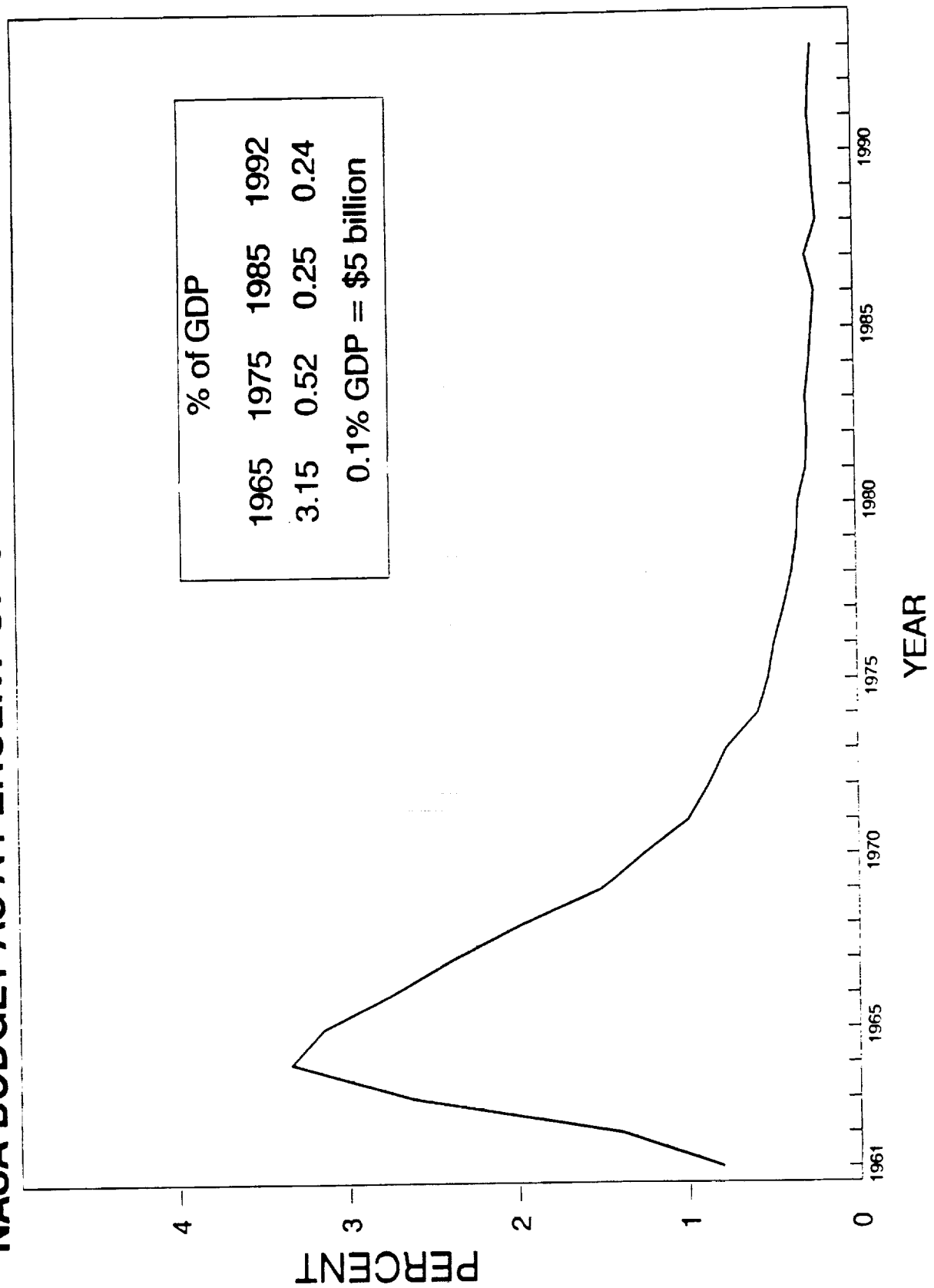
Finally, Pedersen pointed to the fact that a WSA cannot replace or substitute for flagging national will. If the problem is that we are not doing a good enough job convincing our own governments that space deserves more attention and resources, we cannot hope that an international organization is going to do that better.

Not to end on a discouraging note, Pedersen concluded that international cooperation in the form of collaboration between governments and particularly among companies, is a worldwide and growing phenomenon. Conditions are being created today that will, someday, form the basis of something like a World Space Agency. It will likely emerge in building block fashion. Today, however, we have little experience with sustained and enduring international institutions, outside the context of the European Space Agency.

Some steps that could be taken in the near future to foster institution building are meetings that bring together all heads of spacefaring nations; build on the experiences of such ad hoc groups as the Space Agency Forum on International Space Year (SAFISY) that pull together diverse interests and coordinate activities; make better use of existing mechanisms, such as the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS); use such projects as the Mission to and from Planet Earth as laboratories for governmental and industrial space partnerships and to experiment with shared management techniques.

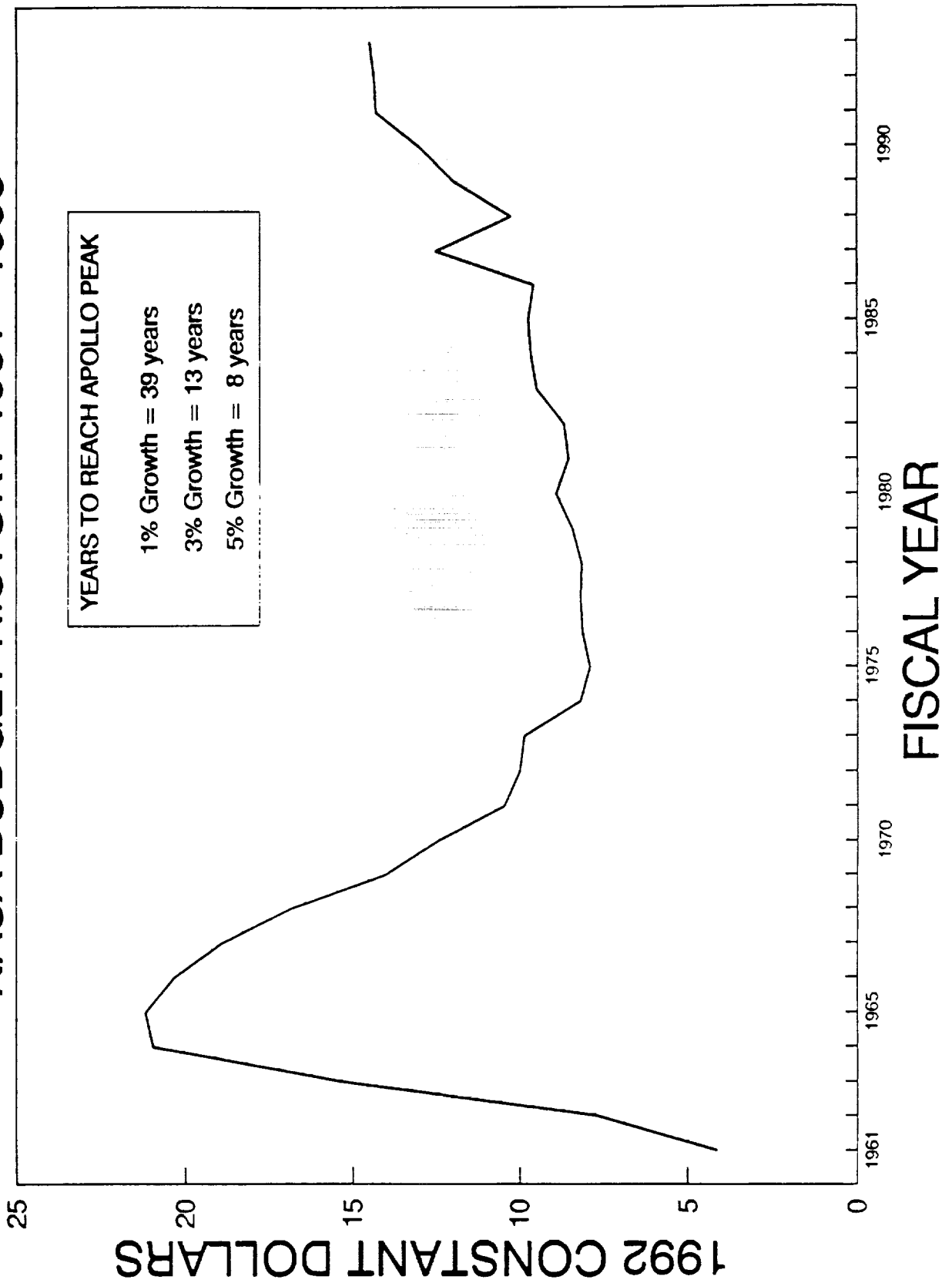


# NASA BUDGET AS A PERCENT OF GROSS DOMESTIC PRODUCT





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